WE CLAIM:

1. An interferential position measuring arrangement for determining the relative positions of a first object and a second object which are movable with respect to each other at least in a measuring direction, comprising:

a light source connected to a first object, which emits a beam of rays in a direction of an optical axis;

an optical element arranged downstream of said light source, which converts said beam of rays emitted by said light source into an incoming beam of rays;

a scale grating connected to a second object that moves relative to said first object and arranged downstream of said light source, which splits said incoming beam of rays at least into:

a first partial beam of rays, which is propagated into a first spatial direction;

a second partial beam of rays, which is propagated into a second spatial direction that is different from said first spatial direction;

a first scanning grating that is arranged in a beam path of said first partial beam of rays and causes splitting of said first partial beam of rays into third and fourth partial beams of rays;

a second scanning grating that is arranged in a beam path of said second partial beam of rays and causes splitting of said second partial beam of rays into fifth and sixth partial beams of rays, wherein at least two of said third, fourth, fifth and sixth partial beams of rays meet again, and wherein in the case of relative movement between said scale grating and said light source, a periodically modulated interferential fringe pattern with a definite spatial interferential fringe pattern period results in a detection plane;

a detection arrangement arranged in said detection plane, which causes splitting of light entering through said detection arrangement into at least three different spatial

directions; and optoelectronic detector elements arranged in said at least three spatial directions for detecting phase-shifted scanning signals.

2. An interferential position measuring arrangement in accordance with claim 1, wherein said light source comprises a semiconductor light source.

3. An interferential position measuring arrangement in accordance with claim 1, wherein said optical element comprises a lens.

4. An interferential position measuring arrangement in accordance with claim 1, wherein said scale grating comprises a phase grating, and said first and second partial beams of rays correspond to the +/- 1st orders of diffraction, respectively.

5. An interferential position measuring arrangement in accordance with claim 3, wherein said scale grating comprises a phase grating with a bar-to-gap ratio $\eta_{MG} = 1:1$, as well as a phase depth $\varphi_{MG} = 180°$.

6. An interferential position measuring arrangement in accordance with claim 1, wherein said first scanning grating comprises a phase grating, and said third and fourth partial beams of rays respectively correspond to the +/- 1st orders of diffraction, respectively.

7. An interferential position measuring arrangement in accordance with claim 5, wherein said first scanning grating comprises a phase grating with a bar-to-gap ratio $\eta_{MG} = 1:1$, as well as a phase depth $\varphi_{MG} = 180°$, and has a scanning grating graduation period which is less than a scale grating graduation period of said scale grating.

8. An interferential position measuring arrangement in accordance with claim 1, wherein said first and second scanning gratings are arranged together on a scanning plate.

9. An interferential position measuring arrangement in accordance with claim 8, wherein said scanning plate is embodied to be opaque outside areas of said first and second scanning gratings.

10. An interferential position measuring arrangement in accordance with claim 1, wherein said first scanning grating is arranged at a distance a_1 from said scale grating, in which

at least said first and second partial beams of rays are located spatially separated from each other.

11. An interferential position measuring arrangement in accordance with claim 1, wherein the following applies for a distance a_1 between said scale grating and said first scanning grating, and a distance a_2 between said first scanning grating and said detection plane:

$$\frac{a_2}{a_1} = 2\frac{P_{IF}}{TP_{MG}}\sqrt{\frac{1-(\lambda/TP_{MG})^2}{1-(\lambda/2P_{IF})^2}}$$

wherein

a_1 = distance between said scale grating and said first scanning grating;

a_2 = distance between said first scanning grating and said detection plane;

TP_{MG} = graduation period of said scale grating;

P_{IF} = spatial strip pattern period in said detection plane

λ = wavelength of said light source.

12. An interferential position measuring arrangement in accordance with claim 11, wherein the following applies for a graduation period of said scanning grating:

$TP_{AG} = 1/(1/TP_{MG} + 1/2\ P_{IF})$,

wherein

TP_{AG}: = graduation period of said scanning grating.

13. An interferential position measuring arrangement in accordance with claim 1, wherein said scanning grating is arranged in an area of beam waist of said beam of rays converted by said optical element.

14. An interferential position measuring arrangement in accordance with claim 1, wherein the detection arrangement is embodied as a phase grating, which splits incoming light at least into the zero order of diffraction, as well as into the +/- 2nd orders of diffraction.

15. An interferential position measuring arrangement in accordance with claim 14, wherein said detection arrangement comprises a phase grating with a bar-to-gap ratio η_{MG} = 1:2, or η_{MG} = 2:1, as well as a phase depth of 120° or 240°, and has a detector grating graduation period corresponding to twice said spatial interferential fringe pattern period.

16. An interferential position measuring arrangement for determining the relative positions of a first object and a second object which are movable with respect to each other at least in a measuring direction, comprising:

a light source connected to a first object, which emits a beam of rays in a direction of an optical axis;

an optical element arranged downstream of said light source, which converts said beam of rays emitted by said light source into an incoming beam of rays;

a scale grating connected to a second object that moves relative to said first object and arranged downstream of said light source, which splits said incoming beam of rays at least into:

a first partial beam of rays, which is propagated into a first spatial direction;

a second partial beam of rays, which is propagated into a second spatial direction that is different from said first spatial direction;

a first scanning grating that is arranged in a beam path of said first partial beam of rays and causes splitting of said first partial beam of rays into third and fourth partial beams of rays;

a second scanning grating that is arranged in a beam path of said second partial beam of rays and causes splitting of said second partial beam of rays into fifth and sixth partial beams of rays, wherein at least two of said third, fourth, fifth and sixth partial beams of rays

meet again, and wherein in the case of relative movement between said scale grating and said light source, a periodically modulated interferential fringe pattern with a definite spatial interferential fringe pattern period results in a detection plane;

a detection arrangement arranged in said detection plane for detection of phase-shifted scanning signals, said detection arrangement comprising a plurality of individual detector elements, wherein a detection period of said individual detector elements is matched to said spatial interferential fringe pattern period.

17. An interferential position measuring arrangement in accordance with claim 16, wherein said light source comprises a semiconductor light source.

18. An interferential position measuring arrangement in accordance with claim 16, wherein said optical element comprises a lens.

19. An interferential position measuring arrangement in accordance with claim 16, wherein said scale grating comprises a phase grating, and said first and second partial beams of rays correspond to the +/- 1st orders of diffraction, respectively.

20. An interferential position measuring arrangement in accordance with claim 18, wherein said scale grating comprises a phase grating with a bar-to-gap ratio $\eta_{MG} = 1:1$, as well as a phase depth $\varphi_{MG} = 180°$.

21. An interferential position measuring arrangement in accordance with claim 16, wherein said first scanning grating comprises a phase grating, and said third and fourth partial beams of rays respectively correspond to the +/- 1st orders of diffraction, respectively.

22. An interferential position measuring arrangement in accordance with claim 20, wherein said first scanning grating comprises a phase grating with a bar-to-gap ratio $\eta_{MG} = 1:1$, as well as a phase depth $\varphi_{MG} = 180°$, and has a scanning grating graduation period which is less than a scale grating graduation period of said scale grating.

23. An interferential position measuring arrangement in accordance with claim 16, wherein said first and second scanning gratings are arranged together on a scanning plate.

24. An interferential position measuring arrangement in accordance with claim 23, wherein said scanning plate is embodied to be opaque outside areas of said first and second scanning gratings.

25. An interferential position measuring arrangement in accordance with claim 16, wherein said first scanning grating is arranged at a distance a_1 from said scale grating, in which at least said first and second partial beams of rays are located spatially separated from each other.

26. An interferential position measuring arrangement in accordance with claim 16, wherein the following applies for a distance a_1 between said scale grating and said first scanning grating, and a distance a_2 between said first scanning grating and said detection plane:

$$\frac{a_2}{a_1} = 2\frac{P_{IF}}{TP_{MG}}\sqrt{\frac{1-(\lambda / TP_{MG})^2}{1-(\lambda / 2P_{IF})^2}}$$

wherein

a_1 = distance between said scale grating and said first scanning grating;

a_2 = distance between said first scanning grating and said detection plane;

TP_{MG} = graduation period of said scale grating;

P_{IF} = spatial strip pattern period in said detection plane

λ = wavelength of said light source.

27. An interferential position measuring arrangement in accordance with claim 26, wherein the following applies for a graduation period of said scanning grating:

$TP_{AG} = 1/(1/TP_{MG} + 1/2\ P_{IF})$,

wherein

TP_{AG}: = graduation period of said scanning grating.

28. An interferential position measuring arrangement in accordance with claim 16, wherein said scanning grating is arranged in an area of beam waist of said beam of rays converted by said optical element.

29. An interferential position measuring arrangement in accordance with claim 16, wherein said detector period is matched to said spatial interferential fringe pattern period in such a way that adjoining ones of said plurality of individual detector elements are each provided with scanning signals which are phase-shifted by 90° with respect to each other.

30. An interferential position measuring arrangement in accordance with claim 29, wherein four of said plurality of individual detector elements are arranged within said spatial interferential fringe pattern period.

31. An interferential position measuring arrangement in accordance with claim 16, wherein said plurality of individual detector elements are connected in an electrically conducting manner which provide identically phased scanning signals.